

Infrared Spectroscopy with 100-nm Spatial Resolution: Applications in Polymers and Life Sciences

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Atomic Force Microscopy (AFM) and infrared (IR) spectroscopy have been combined in a single instrument capable of producing 100-nm spatial resolution IR spectra and images. This new capability enables the spectroscopic characterization of domains in polymeric samples at levels not previously possible. A tunable IR laser source generating pulses on the order of 10 ns was used for excitation of cast sample films or thin cross sections deposited on IR transparent ZnSe prisms. Short duration thermal waves, due to infrared absorption, were studied by monitoring the resulting excitation of the contact resonance modes of the AFM cantilever. Differences in the IR spectra as a function of spatial position provide insight into polymer blend miscibility, microdomain formation, and can lead to increased understanding of how fibers and other nanomaterial additives affect the molecular structure and properties of polymer materials.